NIAGARA FALLS

GRAND TRUNK RAILWAY
SYSTEM

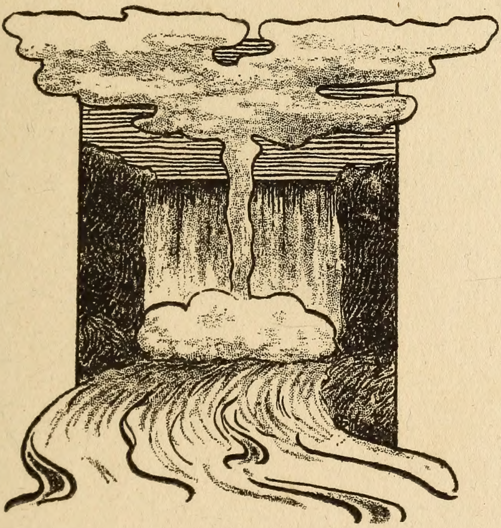
Presented to the
LIBRARY *of the*
UNIVERSITY OF TORONTO
by

Mrs. Rachel Grover

Digitized by the Internet Archive
in 2015

https://archive.org/details/acrossniagarasgo00gran_0

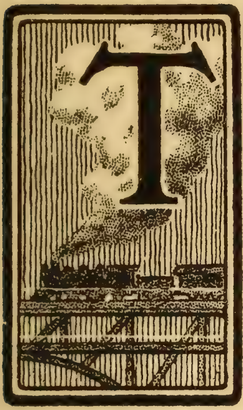
ACROSS NIAGARA'S GORGE



GRAND TRUNK RAILWAY SYSTEM

Canadian Fall from Below

NIAGARA FALLS



THE countless thousands who visit the Cataract of Niagara pronounce it the greatest natural wonder on the American continent. Next in sublimity and grandeur to the waterfall itself, is the Gorge through which the waters, after their awful plunge over the cliff, rush onward to Lake Ontario. For a little distance from the foot of the Falls the stream is comparatively placid, but gathering momentum as its channel narrows, it fills the Gorge and rushes over the rocks in foamy rapids; here breaking into spray, and there springing high in the air, as it dashes against some rocky obstruction in its mad race for the calmer reaches of the bed below.

Over this tumultuous stream, reaching from bank to bank in a single graceful span, is the

GRAND TRUNK STEEL ARCH BRIDGE.

Second in wonder and sublimity only to the great cataract itself, it lends an added interest to a visit to Niagara by its beauty and grace as a feature of the landscape, and as a triumph of engineering skill—a worthy companion piece of man's handiwork to be associated with the great works of nature among which it is placed. It stands exactly where for more than forty years the world-renowned Suspension Bridge had spanned this Gorge, and was so long regarded as the crowning triumph of engineering skill. Scarcely less wonderful than the bridge itself is the fact that its construction was completed without the interruption of traffic, the old bridge serving its regular uses until the new bridge was sufficiently advanced to allow of its removal. The engraving shown in this publication will give a good general idea of the structure, and the principles involved in its construction. From abutments on either bank springs a steel arch, spanning the Gorge, with its highest point 226 feet above the water. The span between the piers is 550 feet, and a trussed span at each end 115 feet long connects the arch with the bluff. The total length of the bridge with its approaches is over 1,100 feet. It has two decks or floors, the upper one, thirty feet wide, occupied by the double track of the Grand Trunk Railway System, the lower comprising a broad carriageway in the center, with foot-walks outside of all, making a total width of fifty-seven feet.

Old Suspension Bridge

The sustaining strength of the structure is enormous, being six times that of the old bridge. The bridge was fashioned by the Pennsylvania Bridge Co., at Steelton, Pa., and shipped in sections, the main arch ribs weighing twenty-five tons each.

The removal of the old bridge revealed the fact that it was still good for many years of service; but the policy of the Grand Trunk Railway System has ever been that of taking no chances, and this expenditure of a half million dollars was made to insure absolute safety.

The bridge was formally dedicated to the public service by a three days' carnival, September 23, 24 and 25, 1897, and the event will long be remembered by the thousands who participated in the festivities.

Grand Trunk Steel-Arch Bridge

This little work is designed to serve, not only as a souvenir of the Steel Arch Bridge, but of the Falls as well, and we therefore give a brief description of the principal attractions, illustrated by halftone engravings from fine photographs; so that this booklet may prove a pleasant reminder of sights enjoyed, or pleasures missed.

The visitors arriving by the trains of the Grand Trunk System may take a carriage at the Niagara Falls station in Canada, or may cross the river by the Steel Arch Bridge to Suspension Bridge

General View from Bridge

station, and then proceed by carriage or electric street car line to Niagara Falls, N. Y., alighting from the car at the entrance to Prospect Park, or continuing the trip, if by carriage, to the various points of interest.

From Prospect Point, a comprehensive view of the entire Falls may be had, with the American Fall in the foreground, the Horseshoe in the distance, and the Canadian Fall and Table Rock diagonally across the Gorge. The upper station of the Inclined Railway is in Prospect Park, and the car takes you to the dock of the steamer, "Maid of the Mist," which makes frequent trips up the stream, to a point excitingly near the foot of the Falls.

From Prospect Park, the visitor may cross to Goat Island, Luna Island and the "Three Sisters," all connected by a chain of bridges. Luna Island is reached by a stairway down the bank and a handsome bridge, and here one may stand at the very brink of the Central and American Falls, and gaze, fascinated, at the water as it plunges over the cliffs.

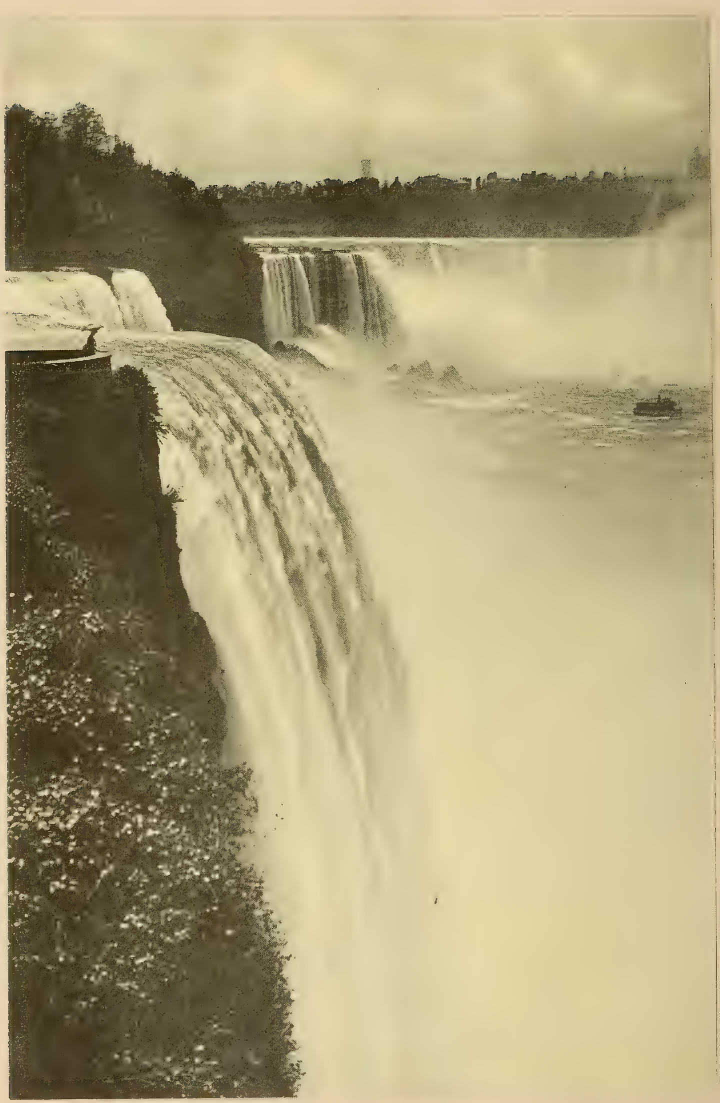
American Fall

From Goat Island, a visit may be made, in suitable waterproof garments, to the Cave of the Winds, a recess under the Central Fall, about one hundred feet long and one hundred feet high, where the strong air currents, dashing the mist and spray, remind one of a Dakota blizzard.

American Fall in Winter

The view from Terrapin Point, also reached from Goat Island, is very comprehensive, as being the nearest point of approach to the Horseshoe, with all the cataracts visible from one point of observation.

American Fall in Summer



General View from Prospect Park

Three Sister Islands

From the Sister Islands, fine views of the rapids are to be had, and the outermost islet presents to the observer the grand sweep of the river, and gives a good idea of the immense volume of water which goes to make up the grand cataracts.

The Canadian side of the river may be reached by the steamer "Maid of the Mist," or by the new bridge, which crosses the river at the place formerly spanned by the structure so long known as the "New Suspension Bridge." This bridge, like its elder prototype, has now given place to a new one in a similar style of construction, a steel arch, and the views of the Falls afforded in crossing it are among the best.

From the Canadian shore, the views of the Falls are superb, that from "Inspiration Point" being regarded as the finest, comprising, as it does, the American, Bridal Veil, Central and Horseshoe Falls,

American Fall from Below

in one glance, together with the island views opposite, and the grand sweep of the rapids as far as the eye can reach.

From here the visitor may descend the bank and go under the Horseshoe Falls, attired in waterproof garments and accompanied by a trusty guide.

Dufferin Islands, with shady walks and drives, with the Burning Spring a little distance beyond, are attractive to the pedestrian, and equally accessible by carriage. From the islands fine views of the Canadian rapids are to be had.

The views of the Gorge below the Falls, for almost its entire length, present a succession of delightful surprises, scarcely less attractive than those of the cataract itself. These are now rendered accessible by two electric lines, on either bank of the river. The Canadian line extends from a point about one and a half miles above the village of Chippewa, along the bank of the river,

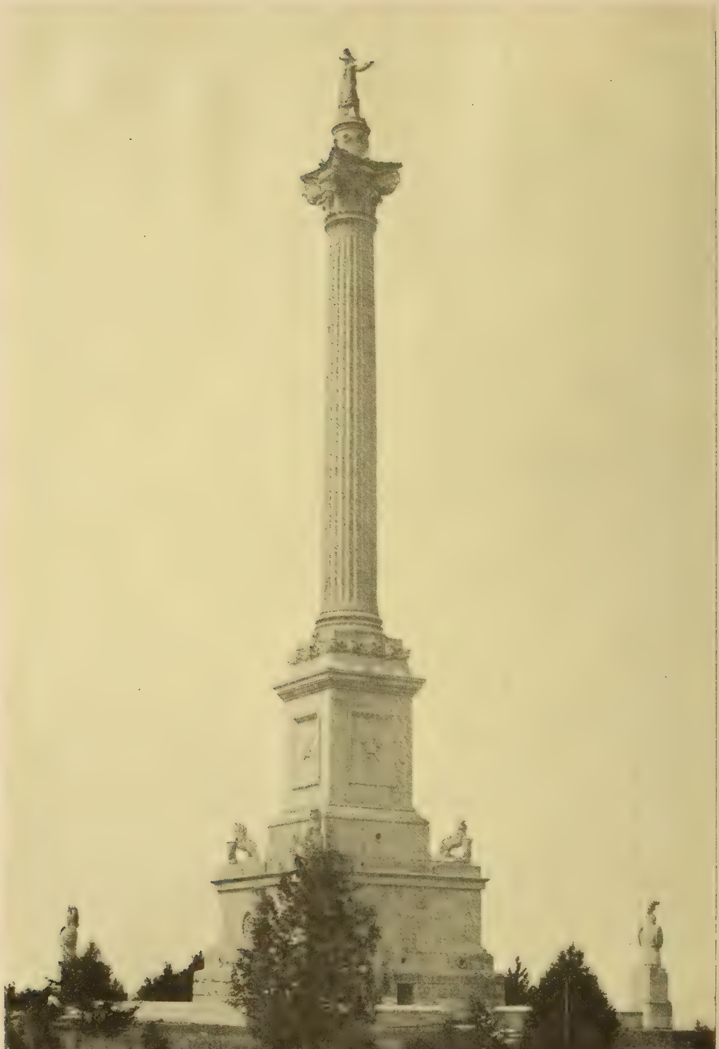
Bridge to Goat Island

passing in full view of the Falls, continuing on past the railroad bridges, by the Whirlpool Rapids, rounding the circular turn of the bank at the Whirlpool itself; thence on the high bank of the river,

Cave of the Winds in Winter

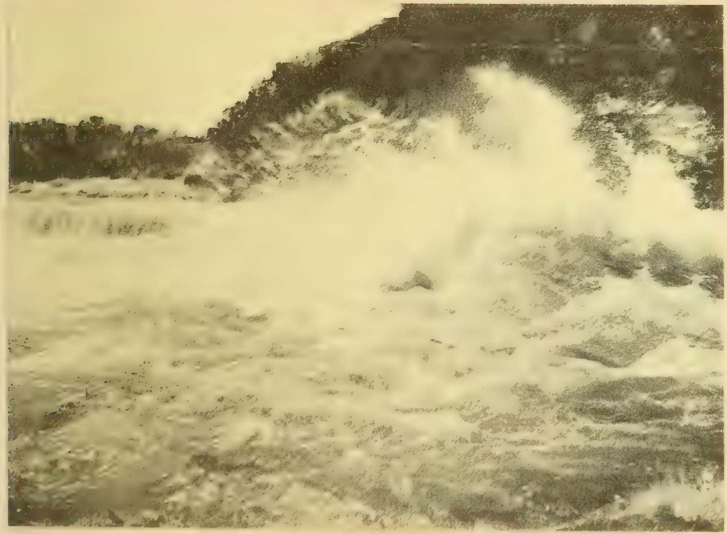
past Brock's Monument, and down the cliff to Queenston, a quiet village on the river bank, opposite Lewiston on the American shore. Stops by the way may be made if desired. At Brock's Monument a beautiful view is to be had from the terrace, while from the monument itself, the panorama spreads out in surpassing beauty. The Duke of Argyle pronounced it an ample reward for crossing the Atlantic. At Queenston a tablet erected by the Prince of Wales, marks the spot where Brock fell. The other electric line is known as the "Gorge Route," and commences at Prospect Park, Niagara Falls, N. Y., passing through a portion of the city; thence down the bank of the river nearly to the water's level, skirting the shore in close proximity to the rapids, following

The Whirlpool



Brock's Monument

the curve of the stream opposite the Whirlpool, and ending at Lewiston. The visitor who goes down by one route and returns by the other, will have a better idea of the Gorge than can be had by any other method. The Whirlpool will be seen from both sides, and the rapids from above and below. The latter are declared, by many visitors, to be grander and more awe-inspiring than the cataracts. The apparently resistless force of the water, its swift current and never-ceasing roar, together with the gigantic columns of spray shooting high in the air, all combine to fascinate the onlooker, and hold the gaze as by a magic spell. The illustration above, reproduced from an instantaneous photograph, gives a faint idea of what a single glance reveals, and suggests the awful grandeur of the mighty river, here fighting its way through the narrow gorge.



Whirlpool Rapids

In taking leave of Niagara's Gorge, and the grand structure by which it is crossed, it may not be amiss to remark that the latter is but one of a series of engineering achievements which have marked the history of the Grand Trunk Railway System. The famous

Terrapin Point in Winter

Victoria Jubilee Bridge across the St. Lawrence at Montreal, the great International Bridge at Buffalo, and the justly famous St. Clair Tunnel, connecting Sarnia and Port Huron, are examples of the enterprising spirit that has characterized its management. Connecting, as it does, the Atlantic seaboard with the Great Lakes, and passing through some of the finest scenery on the American continent, it has readily acquired the distinctive title of the Great International Tourist Route.

Bridge to Luna Island

ELECTRICAL DEVELOPMENT

ON CANADIAN TERRITORY AT NIAGARA FALLS

THE ELECTRICAL DEVELOPMENT COMPANY OF ONTARIO, LIMITED,

Is the only Niagara Power Company owned, controlled and built by British and Canadian capital. The construction work is rapidly being completed, and the first turbines are expected to be in operation by July or August next. A few particulars of this colossal undertaking will be of interest.

The Power House and Headworks are located on land formerly the river bed, and to build the headworks required the unwatering of eleven acres of the most turbulent part of the Niagara River above the Falls. The accomplishment of this necessitated the construction of a coffer-dam 2,200 feet long, extending from the shore immediately below the Dufferin Islands, and running out into the river and down stream through the cascade and dangerous rapids above the Falls, where a twenty-foot depth of water was encountered for a considerable distance. The coffer-dam having been constructed, a huge gathering dam, 736 feet long by 33 feet 3 inches wide, made of solid concrete with a granite coping, was erected to act as a diverting wall to the river water and to equalize the flow of water on the turbines. This wall also has the effect of quieting the forebay waters, and assuring a uniform quantity or supply, as the surplus not required will flow over the top of the dam. The headwalls and intakes are next encountered in the progress of the water after it has crossed the immense forebay. These walls, or rows of submerged arches, are three in number. The first wall contains 22 arches, and extends from the up-stream end of the power house about 420 feet, terminating in a junction with the gathering dam, an opening at the junction being left for the escape of floating ice. The second row of arches is set at alternate opposite intervals to the first, and the walls parallel each other, the object of this being that any ice that passed the first row would strike the abutments of the second, and be carried down stream and over a second overflow at the foot or down-stream end. The ice racks and enclosed forebay will be covered by the power house proper. The water, after passing the ice racks, the gates being open, will enter the huge intakes leading to the penstocks or turbine feeders, which are eleven in number, and have a diameter of 10 feet 6 inches. These penstocks are set in the wheel-pit, which is an immense pit cut out in the solid limestone, the dimensions being, length 416 feet, width 22 feet, by 140 feet deep, and the magnitude of this immense excavation is one of the main features of the undertaking.

After entering these penstocks, the water drops to the turbine wheels at the bottom of the pit, the effective head being 136 feet. These turbines are the largest in use known, and are capable of generating 15,000 horse-power each. The water, after passing through the turbines, will be discharged into branch tunnels on either side of the wheel-pit, 520 feet in length; five discharging to the left or shore side, and six to the right or river side. The construction of these branch tunnels practically constitutes two separate plants, as it will be possible at any time to shut down half the units for inspection or repairs, without interfering with the remainder of the plant—a most desirable feature which is not to be found in any of the other developments. These branch tunnels meet about 100 feet below the end of the wheel-pit and open into a tail race tunnel 26 1-2 feet high and 23 feet wide, of horseshoe shape, and 1,900 feet long, running in a straight line directly under the bed of the river, at a depth of 160 feet, and having its portal or discharge end almost in the center and at the foot of the Horseshoe Falls, about six feet above high water. The calculated velocity of the water in the tunnel will be 26 feet per second.

To return to the wheel-pit, each turbine is connected by a vertical shaft, supported on masonry bearings, to a generator on the power house floor above. These generators are the largest ever manufactured, and are of 12,500 horse-power each, of the vertical internal revolving field type, and generate power at 12,000 volts.

The total capacity of the plant will thus be 125,000 horse-power, and this will use the capacity of ten generators, the eleventh being held in reserve.

CANADIAN NIAGARA POWER COMPANY.

The Canadian Niagara Power Company was incorporated by an act of the Legislature of the Province of Ontario in the year 1892, which act confirms a certain agreement, dated April 7, 1892, with the Commissioners for the Queen Victoria Niagara Falls Park, providing that the Power Company shall have the right, for one hundred years, to construct and operate works within the Park, by means of canals, wheel-pits and tunnels for the development of electrical and pneumatic power for transmission, distribution and sale without the Park. This company is an allied company of The Niagara Falls Power Company, which has built the two power houses on the American side, and it now has under construction a development of 110,000 e. h. p.

The power house is situated in the Queen Victoria Niagara Falls Park, about half a mile above the Horseshoe Falls. The water is taken in from the river through a short canal and forebay, discharged through penstocks into turbines near the bottom of a wheel-pit, and carried away to the lower river through a tunnel about 2,000 feet in length.

The most distinctive feature of this plant is the size of the generating units, each of which is to have a capacity of 10,000 h. p.,—being among the largest machines thus far constructed. The plant, when completed, will include eleven of these generators. A unit of this size was adopted for reasons of economy in hydraulic development and in electrical equipment. These 10,000 h. p. units occupy but little more space than those of 5,000 h. p. Thus results a great reduction in length of wheel-pit and power house for a given horse-power output. Furthermore, the generators cost considerably less per horse-power than those of 5,000 h. p. capacity.

The generators will have vertical shafts, and are wound for three-phase current, 11,000 volts, 25 cycles at 250 revolutions per minute. This high-generated voltage was selected for economy in local distribution of power. The cost of distributing underground at 11,000 volts, three-phase, is about one-fifth that required for a 2,200-volt, two-phase system. For long-distance transmission, step-up transformers have been installed in a transformer house outside of the Park and will be used to raise the voltage to 22,000, 40,000 or 60,000 volts, depending upon the distance of transmission.

THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

Niagara River descends more than 200 feet between the upper line of breakers opposite Dufferin Islands and the foot of Horseshoe Falls. To utilize this head of water, the Ontario Power Company has laid a pipe from an intake at these islands for more than a mile down stream along the Canadian bank of the river, and then dropped it to an electric generating station at the water level in

Niagara canyon opposite Goat Island. With the intake of the pipe line above the upper rapids, and the power house in the canyon below the Falls, nearly 55 feet are added to the head of water available from the cataract alone. This pipe line also passes the series of cascades that extends three-fourths mile up-stream from the Falls, and reaches smooth water for the forebay, so that frazil ice will be avoided.

Electrical energy developed near the base of the cataract passes up through cables and conduits in the cliff to a transformer house above for distribution and transmission. Queen Victoria Park is the site of this hydro-electric system from intake to power house, but the transformer station is located on the land of the company.

The distinct features of this power development include the following:

A large, deep forebay with a smooth water surface, and a series of ice screens swept clear by cross currents.

Forebay and penstocks connected by a line of the largest steel water pipe in the world.

Not less than 175 feet of effective head on turbine water wheels.

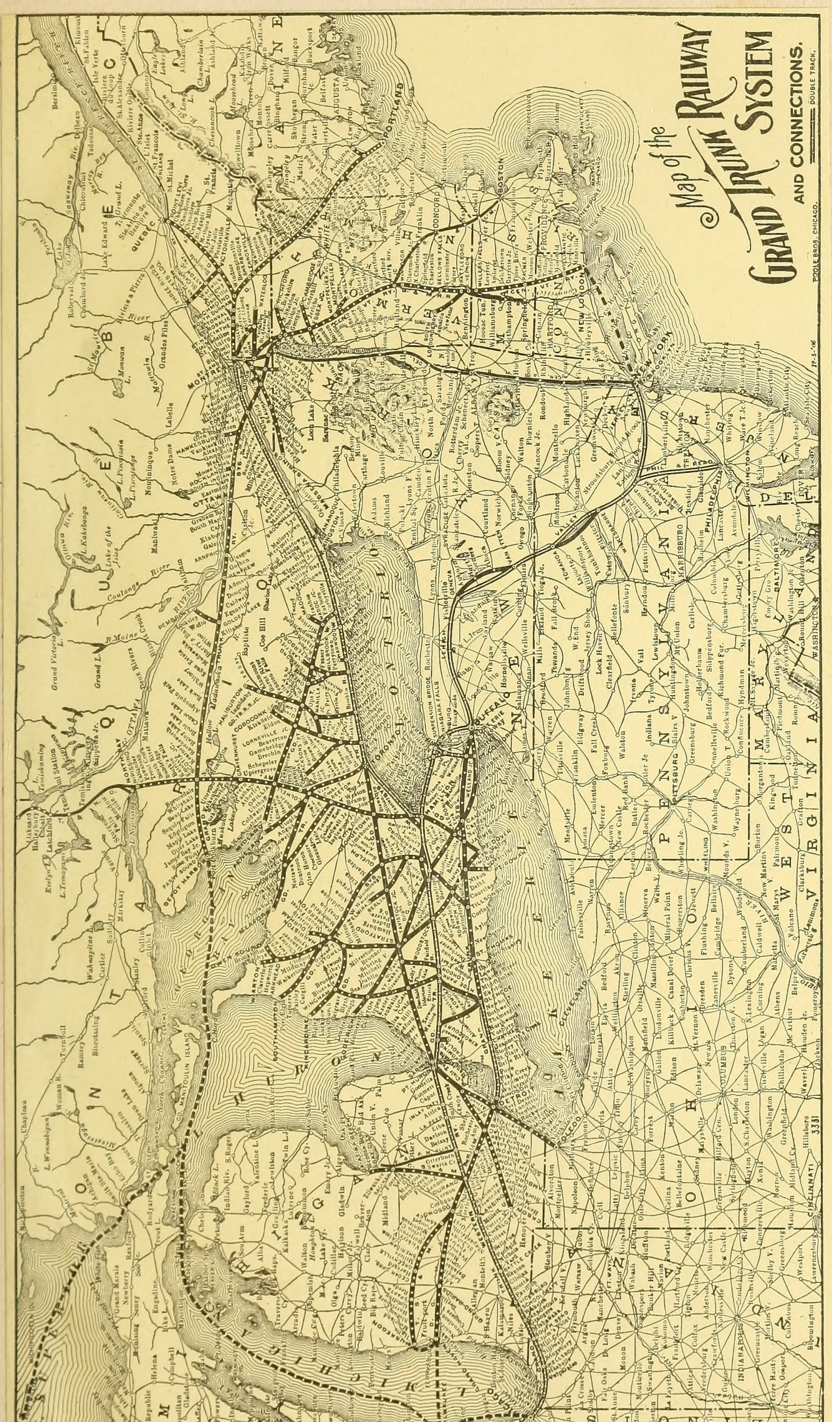
Horizontal turbines and electric generators direct coupled at the bottom of the canyon.

The discharge of tail water from the draft tubes directly into the river.

All main switching and controlling apparatus located in a distant transformer station instead of at the power house.

Isolation of each unit of electrical apparatus consisting of a generator, its transformers and all intermediate connections.

Plans now under way provide for the diversion of not less than 11,700 cubic feet of water per second from the Niagara River at the Dufferin Islands, the transmission of this water to the power house through steel pipes, and for the development therefrom of 135,000 kilowatts or 180,000 electrical horse-power by eighteen generating units.


Map of the
GRAND TRUNK RAILWAY SYSTEM
AND CONNECTIONS.
DOUBLE TRACK.
POOLE BROS. CHICAGO.
333